

REMARKS

Reconsideration is requested in view of the above amendments and the following remarks. Claim 13 has been revised to include some features of claims 17 and 22, with additional revisions. Claims 17 and 22 have been canceled accordingly without prejudice or disclaimer. Claim 18 has been amended editorially. Support for the revisions can be found at, e.g., page 12, lines 8-24 of the specification. Claims 1-12 and 26-30 have been withdrawn from consideration.

Claims 1-16, 18-21 and 23-30 are pending in the application.

Information Disclosure Statement

The English equivalents for each of the following non-English language documents have been provided in the Information Disclosure Statement filed August 22, 2006: JP 2001-261318 corresponds to US 2001/0031346; JP 2004-261632 corresponds to US 2006/0014638; JP 61-26786 corresponds to US 4,643,951 and US 4,619,865. Applicant would provide hard copies of the above references if needed.

Claim rejections – 35 USC§ 102

Claims 13-21, 23, and 24 are rejected as anticipated by U.S. Patent Application Publication No. 2002/0061397 to Iwamura. Applicant respectfully traverses this rejection.

Independent claim 13 is directed to a process for producing a carbon-based thin film, including forming an amorphous carbon-based thin film that includes columnar first phases and a second phase intervening between the first phases, and after forming the amorphous carbon-based thin film, forming a graphite structure at least in the second phase by supplying energy to the amorphous carbon-based thin film, wherein the amorphous carbon-based thin film is supplied with the energy by an electron beam irradiation with an intensity of $1 \times 10^{17}/\text{cm}^2 \cdot \text{sec}$ or less.

Iwamura fails to disclose, teach or suggest the above process. Instead, Iwamura discloses a method for producing an onion-like carbon thin film by magnetron sputtering. Iwamura does

not disclose forming an amorphous carbon-based thin film that includes columnar first phases and a second phase as recited in claim 13.

The rejection contends that in the sputtering process of Iwamura, the chamber pressure satisfies the condition recited in applicant's specification, i.e., preferably 10 mTorr or more. That is not correct. While Iwamura discloses a pressure range of 0.5-12 mTorr (see Iwamura, [0044]) which is generally lower than that recited in applicant's specification, all the samples in Iwamura are produced at a pressure of 3 mTorr (see Iwamura, [0051]), which is far below the lower limit, i.e., 10 mTorr, in applicant's specification. Therefore, the sputtering process of Iwamura is different from that recited in applicant's specification. Since the sputtering processes are different, the resulting as-grown thin films are different, i.e., the onion-like carbon thin films of Iwamura vs. the amorphous carbon-based thin film that includes columnar first phases and a second phase of claim 13.

In addition, claim 13 requires at least two separate, sequential steps to produce the carbon-based thin film: (i) forming an amorphous film and (ii) after (i), irradiating the amorphous film of (i) with an electron beam. Iwamura does not disclose the above two sequential steps. Instead, Iwamura discloses a sputtering method where it is required that a thin film is irradiated with an electron beam during the process of forming the thin film (see Iwamura, [0041] and Fig. 4). Once the growth of thin film is completed, the electron beam irradiation stops. Iwamura does not teach irradiating the as-grown, onion-like carbon thin film with an electron beam as a post-growth process step. Therefore, Iwamura fails to disclose the above two sequential steps of claim 13.

For at least these reasons, claim 13 is patentable over Iwamura. Claims 14-16, 18-21, and 23-24 depend ultimately from claim 13 and are patentable along with claim 13 and need not be separately distinguished at this time. Applicant is not conceding the relevance of the rejection to the remaining features of the rejected claims.

Claim rejections – 35 USC§ 103

Claims 22, 24, and 25 have been rejected as unpatentable over Iwamura in view of U.S. Patent No. 6,251,522 to Tanaka et al. Applicant respectfully traverse this rejection.

Claim 13 is patentable over Iwamura for at least the same reasons above. Tanaka et al. do not remedy the deficiencies of Iwamura. Tanaka et al. disclose irradiating a high energy beam film of an intensity of $1 \times 10^{19} e/cm^2 \cdot sec$ onto an amorphous carbon, which is at least about two orders of magnitude higher than the intensity recited in claim 13.

Claims 22, 24 and 25 depend ultimately from claim 13 and are patentable along with claim 13. Applicant is not conceding the relevance of the rejection to the remaining features of the rejected claims.

Claims 13-21, 23, and 24 are alternatively rejected as unpatentable over Iwamura (20020061397), as discussed above, in view of JP2004-261632 to Iwamura. Applicant respectfully traverses this rejection.

For at least the same reasons above, claim 13 is patentable over Iwamura (20020061397). JP2004-261632 to Iwamura does not remedy the deficiencies of Iwamura (20020061397). JP2004-261632 to Iwamura is directed to a hydrogen absorption material using amorphous carbon and a method for the same. JP2004-261632 to Iwamura does not teach or suggest irradiating the amorphous carbon thin film by an electron beam after the formation of the amorphous carbon thin film, let alone forming a graphite structure at least in the second phase with the electron irradiation.

Moreover, it would not be obvious to utilize the amorphous carbon structure of JP2004-261632 to Iwamura in the process of Iwamura (20020061397) to arrive at the process of claim 13. As discussed above, Iwamura (20020061397) does not teach or suggest the two separate sequential steps of claim 13. Instead, the growth of thin film and the electron beam irradiation are performed simultaneously, where there would be no way to utilize the amorphous carbon structure of JP2004-261632 to Iwamura.

Claims 14-16, 18-21, and 23-24 depend ultimately from claim 13 and are patentable along with claim 13 over Iwamura (20020061397) in view of JP2004-261632 to Iwamura. More

specifically, claim 20 recites that the density of the second phase is higher than that of the columnar first phases after the electron irradiation. While JP2004-261632 to Iwamura discloses a columnar first phase 2 and a second phase 4 intervening the first phase 2, the second phase has a lower density than the columnar first phase (see Fig. 1, [0007]), which is contrary to that recited in claim 20. Applicant is not conceding the relevance of the rejection to the remaining features of the rejected claims.

Claims 22, 24, and 25 are alternately rejected as unpatentable over Iwamura, as discussed above, in view of JP2004-261632 (Iwamura), as applied to claim 13, and further in view of Tanaka et al. Applicant respectfully traverses this rejection.

For at least the same reasons above, claim 13 is patentable over Iwamura (20020061397). Neither JP2004-261632 (Iwamura) nor Tanaka remedies the deficiencies of Iwamura (20020061397). Claims 24 and 25 depend ultimately from claim 13 and are patentable along with claim 13 over Iwamura (20020061397) in view of JP2004-261632 to Iwamura and Tanaka et al. Applicant is not conceding the relevance of the rejection to the remaining features of the rejected claims.

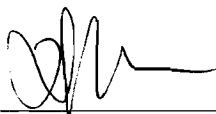
In view of the above, favorable reconsideration in the form of a notice of allowance is respectfully requested. Any questions regarding this communication can be directed to the undersigned attorney, Douglas P. Mueller, Reg. No. 30,300, at (612) 455-3804.

Respectfully submitted,

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